JC02 Rec'd PCT/PTO 27 MAR 2002

FORM-PTO-1390 (Rev. 9-2001) | U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE | ATTORNEY'S DOCKET NUMBER: 009760-016

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5): Unassigned 10/089183

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP00/06910	04 October 2000	08 October 1999

TITLE OF INVENTION: LIQUID CRYSTAL POLYMER COMPOSITIONS

APPLICANT(S) FOR DO/EO/US: TAKAYUKI MIYASHITA, MINEO OHTAKE, and HIROKAZU OHSHIBA

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:

A certified copy of Japanese Patent Application No. 11-287808, filed 08 October 1999, was submitted during the international phase of the examination. Thus the claim for priority has been perfected.

21839

JC13 Rec'd PCT/PTO 27 MAR 2002

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
Unassigned 10/089183	PCT/JP00/06910	009760-016

21. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,040.00 (960)		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $890.00 (970)		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $740.00 (958)		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) $710.00 (956)		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00 (962)		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of **$130.00 (154)** for furnishing the oath or declaration later than 20 ☐ 30 ☐ months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

Claims	Number Filed	Number Extra	Rate		
Total Claims	20 -20 =	0	X$18.00 (966)	$ --	
Independent Claims	1 -3 =	0	X$84.00 (964)	$ --	
Multiple dependent claim(s) (if applicable)			+ $280.00 (968)	$ --	
			TOTAL OF ABOVE CALCULATIONS =	$ 890.00	
Reduction for 1/2 for filing by small entity, if applicable (see below).			+	$ --	-
			SUBTOTAL =	$ 890.00	
Processing fee of **$130.00 (156)** for furnishing the English translation later than 20 ☐ 30 ☐ months from the earliest claimed priority date (37 CFR 1.492(f)).			+	$ --	
			TOTAL NATIONAL FEE =	$ 890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00 (581)** per property			+	$ 40.00	
			TOTAL FEES ENCLOSED =	$ 930.00	
				Amount to be refunded:	$
				charged:	$

a. ☐ Small entity status is hereby claimed.

b. ☒ A check in the amount of $ 930.00 to cover the above fees is enclosed.

c. ☐ Please charge my Deposit Account No. 02-4800 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

d. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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NAME

22,030
REGISTRATION NUMBER

March 27, 2002
DATE

(10/01)

Patent
Attorney's Docket No. 009760-016

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	Box PCT
TAKAYUKI MIYASHITA et al.	Attention: DO/EO/US
Serial No.: Unassigned	
Filed: March 27, 2002	Group Art Unit: Unassigned
For: LIQUID CRYSTAL POLYMER COMPOSITIONS	Examiner: Unassigned

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This is a national phase filing of International Application No. PCT/JP00/06910, filed October 4, 2000.

Please amend the above-identified Application as indicated.

IN THE CLAIMS:

Kindly replace Claims 3 to 6 as follows:

3. (Amended) The composition according to claim 1, wherein the plate-shaped filler (B) consists of at least one substance selected from talc, mica, kaolin and graphite.

4. (Amended) The composition according to claim 2, wherein the fibrous filler (C) is glass fiber.

5. (Amended) The composition according to claim 1, wherein the liquid crystal polymer (A) is a polyester amide.

6. (Amended) A connector which is manufactured from the composition according to claim 1.

Please add the following new Claims 7 to 20:

7. (New) The composition according to claim 2, wherein the plate-shaped filler (B) consists of at least one substance selected from talc, mica, kaolin and graphite.

8. (New) The composition according to claim 3, wherein the fibrous filler (C) is glass fiber.

9. (New) The composition according to claim 7, wherein the fibrous filler (C) is glass fiber.

10. (New) The composition according to claim 2, wherein the liquid crystal polymer (A) is a polyester amide.

11. (New) The composition according to claim 3, wherein the liquid crystal polymer (A) is a polyester amide.

12. (New) The composition according to claim 4, wherein the liquid crystal polymer (A) is a polyester amide.

13. (New) The composition according to claim 7, wherein the liquid crystal polymer (A) is a polyester amide.

14. (New) The composition according to claim 8, wherein the liquid crystal polymer (A) is a polyester amide.

15. (New) The composition according to claim 9, wherein the liquid crystal polymer (A) is a polyester amide.

16. (New) A connector which is manufactured from the composition according to claim 2.

17. (New) A connector which is manufactured from the composition according to claim 3.

18. (New) A connector which is manufactured from the composition according to claim 4.

19. (New) A connector which is manufactured from the composition according to claim 5.

20. (New) A connector which is manufactured from the composition according to claim 7.

REMARKS

The present Amendment modifies the claim format so as to eliminate the use of multiple dependency.

An Information Disclosure Statement is being filed concurrently herewith.

The examination and allowance of the Application are respectfully requested.

Respectfully submitted,

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Filed: March 27, 2002

Attachment to Preliminary Amendment dated March 27, 2002

3. (Amended) The composition according to claim 1 [or 2], wherein the plate-shaped filler (B) consists of at least one substance selected from talc, mica, kaolin and graphite.

4. (Amended) The composition according to claim 2 [or 3], wherein the fibrous filler (C) is glass fiber.

5. (Amended) The composition according to [any of claims 1 to 4] claim 1, wherein the liquid crystal polymer (A) is a polyester amide.

6. (Amended) A connector which is manufactured from the composition [mentioned in any of claims 1-5] according to claim 1.

1/pr1s

DESCRIPTION

LIQUID CRYSTAL POLYMER COMPOSITIONS

Field of the Invention:

The present invention relates to a liquid crystal polymer composition containing a specific plate-shaped filler. More specifically, it relates to a liquid crystal polymer composition which has an excellent low warp and is advantageously used in particular as a connector or the like requiring a low warp after molding and during reflow heating.

Prior Art:

A liquid crystal polymer capable of forming an anisotropic molten phase has been known to be, among thermoplastic resins, a material which is excellent in dimensional accuracy and damping property and generating little flash during molding. A liquid crystal polymer composition reinforced with glass fibers upon making use of such characteristics has been often employed so far as an SMT-adapted connector. In recent years, however, a connector has been further reduced in weight, thickness and size, and such problems have arisen that warp deformation occurs after molding and during reflow heating owing to an unsatisfactory

rigidity caused by an insufficient thickness of a molded article or an internal stress caused by inserting metallic terminals, which results in defective soldering with a substrate. That is, the ordinary reinforcement with glass fibers only has been problematic in that when amounts of glass fibers are increased for enhancing a rigidity, a thin portion is not filled with a resin and terminals inserted are deformed due to a pressure in molding. Thus, materials that can solve all these problems have not existed.

DISCLOSURE OF THE INVENTION

In view of the foregoing problems, the present inventors have assiduously conducted investigations on materials having an excellent low warp, and have consequently found that by compounding a specific amount of a specific plate-shaped filler with a liquid crystal polymer a low warp can be improved without notably decreasing mechanical properties. This finding has led to the completion of the invention.

That is, the invention is to provide a liquid crystal polymer composition in which 5 to 100 parts by weight of a plate-shaped filler (B) satisfying the following formulae (1) and (2) and having an average particle diameter of 0.5 to 100 μm are compounded with 100 parts by weight of a liquid crystal polymer (A).

$D/W \leqq 5$ (1)

$3 \leqq W/H \leqq 200$ (2)

The invention is a composition comprising (A) and (B).

Detailed Description of the Invention:

The invention is described in detail below. The liquid crystal polymer (A) used in the invention refers to a melt-processible polymer capable of forming an optically anisotropic molten phase. Properties of an anisotropic molten phase can be identified by an ordinary polarization detecting method using crossed polarizers. More specifically, identification of an anisotropic molten phase can be performed by observing a molten sample put on a Leitz hot stage in a nitrogen atmosphere at 40x magnification using a Leitz polarizing microscope. The liquid crystal polymer which can be applied to the invention usually transmits polarized light even in a molten stationary state in the examination between crossed polarizers, optically exhibiting an anisotropy.

The liquid crystal polymer (A) is not particularly limited. An aromatic polyester or an aromatic polyester amide is preferable, and a polyester partially containing an aromatic polyester or an aromatic polyester amide in the same molecular chain is also included in its range. Those having an inherent viscosity (I.V.) of, preferably at least

approximately 2.0 dl/g, more preferably 2.0 to 10.0 dl/g when dissolved in pentafluorophenol at 60°C in a concentration of 0.1 % by weight are used.

The aromatic polyester or the aromatic polyester amide as the liquid crystal polymer (A) which can be applied to the invention is especially preferably an aromatic polyester or an aromatic polyester amide containing, as a constituent, at least one compound selected from the group consisting of an aromatic hydroxycarboxylic acid, an aromatic hydroxyamine and an aromatic diamine.

Specific examples thereof include

(1) a polyester mainly comprising at least one of an aromatic hydroxycarboxylic acid and derivatives thereof;

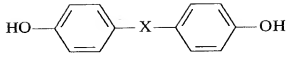
(2) a polyester mainly comprising (a) at least one of an aromatic hydroxycarboxylic acid and derivatives thereof, (b) at least one of an aromatic dicarboxylic acid, an alicyclic dicarboxylic acid and derivatives thereof and (c) at least one of an aromatic diol, an alicyclic diol, an aliphatic diol and derivatives thereof;

(3) a polyester amide mainly comprising (a) at least one of an aromatic hydroxycarboxylic acid and derivatives thereof, (b) at least one of an aromatic hydroxyamine, an aromatic diamine and derivatives thereof and (c) at least one of an aromatic dicarboxylic acid, an alicyclic dicarboxylic acid and

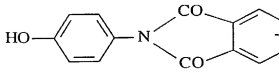
derivatives thereof; and

(4) a polyester amide mainly comprising (a) at least one of an aromatic hydroxycarboxylic acid and derivatives thereof, (b) at least one of an aromatic hydroxyamine, an aromatic diamine and derivatives thereof, (c) at least one of an aromatic dicarboxylic acid, an alicyclic dicarboxylic acid and derivatives thereof and (d) at least one of an aromatic diol, an alicyclic diol, an aliphatic diol and derivatives thereof. Further, a molecular weight modifier may be used in combination with the foregoing components.

Preferable examples of the specific compounds constituting the liquid crystal polymer (A) which can be applied to the invention include aromatic hydroxycarboxylic acids such as p-hydroxybenzoic acid and 6-hydroxy-2-naphthoic acid; aromatic diols such as 2,6-dihydroxynaphthalene, 1,4-dihydroxynaphthalene, 4,4'-dihydroxybiphenyl, hydroquinone, resorcin and compounds represented by the following formulae (I) and (II); aromatic dicarboxylic acids such as terephthalic acid, isophthalic acid, 4,4'-diphenyldicarboxylic acid, 2,6-naphthalenedicarboxylic acid and compounds represented by the following formula (III); and aromatic diamines such as p-aminophenol and p-phenylenediamine.



(I)



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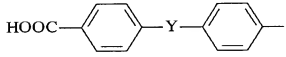


(III)

An especially preferable liquid crystal polymer (A) which is applied to the invention is an aromatic polyester amide containing p-hydroxybenzoic acid, 6-hydroxy-2-naphthoic acid, terephthalic acid and p-aminophenol as main structural unit components.

In order to attain the low warp aimed at by the invention, it is required to compound 5 to 100 parts by weight of a specific plate-shaped filler (B) with 100 parts by weight of the liquid crystal polymer (A).

The plate-shaped filler (B) used in the invention has to satisfy the following formulae (1) and (2). That is, it refers to a disk-shaped, square plate-shaped, rectangular plate-shaped or indefinite plate-shaped material which has dimensions in two directions but not in the remaining one direction. Its average particle diameter is 0.5 to 100 μm.

$D/W \leqq 5$ (1)

$3 \leqq W/H \leqq 200$ (2)

wherein D is the maximum particle diameter of the plate-shaped filler (B), the direction of the diameter D is defined as x, W is a particle's diameter which is in the direction y at the right angle to the direction x, and H is a thickness of the particle in the direction z which is vertical to the xy-plane.

Specific examples of such a plate-shaped filler include talc, mica, kaolin, clay, graphite, vermiculite, silicates such as calcium silicate, aluminum silicate and feldspar powder, Japanese acid clay, agalmatolite clay, sericite, sillimanite, bentonite, glass flake, slate powder and silane; carbonates such as calcium carbonate, chalk, barium carbonate, magnesium carbonate and dolomite; sulfates such as barite powder, precipitated calcium sulfate, calcined gypsum and barium sulfate; hydroxides such as hydrated alumina; oxides such as alumina, antimony oxide, magnesia, titanium oxide, zinc oxide, silica, siliceous sand, quartz, white carbon and diatomaceous earth, sulfides such as molybdenum disulfide; substances comprising the materials such as plate-shaped wollastonite and metallic powders.

Of these, talc, mica, kaolin, clay and graphite are preferable in view of properties.

For attaining the low warp, the higher the content of

the plate-shaped filler, the better. However, when the content is too high, an extrudability and a moldability, especially, a fluidity, are worsened, and further mechanical strengths are decreased. Moreover, when the content is too low, the low warp is not exhibited. Accordingly, the content of the plate-shaped filler (B) is 5 to 100 parts by weight, preferably 10 to 60 parts by weight per 100 parts by weight of the liquid crystal polymer (A).

In addition, for improving mechanical properties, a fibrous filler (C) having an average fiber diameter of 5 to 20 μm and an average aspect ratio of at least 15 can further be compounded.

As the fibrous filler (C), a glass fiber, a milled carbon fiber, a fibrous wollastonite, a whisker, a metallic fiber, an inorganic filler and an ore fiber can be used. As the milled carbon fiber, a PAN fiber containing polyacrylonitrile as a starting material and a pitch fiber containing a pitch as a starting material are used.

As the whisker, a silicon nitride whisker, a silicon trinitride whisker, a basic magnesium sulfate whisker, a barium titanate whisker, a silicon carbide whisker and a boron whisker are used.

As the metallic fiber, fibers of soft steel, stainless steel, steel and alloys thereof, brass, aluminum, and alloys

thereof and lead are used.

As the inorganic fiber, fibers of rock wool, zirconia, alumina silica, potassium titanate, barium titanate, titanium oxide, silicon carbide, alumina, silica and blast furnace slag are used.

As the ore fiber, asbestos is used.

Of these, a glass fiber is preferable in view of properties. As the glass fiber, ordinary glass fibers as well as glass fibers coated with metals such as nickel and copper and a silane fiber are available.

With respect to the content of the fibrous filler for attaining the low warp, when the content is too high, an extrudability and a moldability, especially a fluidity are worsened. Meanwhile, when the content is too low, mechanical properties are decreased. Accordingly, the content of the fibrous filler (C) is 5 to 100 parts by weight, preferably 10 to 50 parts by weight per 100 parts by weight of the liquid crystal polymer (A).

In this case, the plate-shaped filler (B) serves to improve the low warp. However, when the content is too high, an extrudability and a moldability are worsened to make the material brittle. The fibrous filler (C) serves to improve mechanical properties. However, when the content is too high, deformation in reflow is increased. Consequently, the total

content of components (B) and (C) has to be 150 parts by weight or less, preferably 100 parts by weight or less per 100 parts by weight of the liquid crystal polymer (A).

The plate-shaped filler and the fibrous filler used in the invention can be used by themselves. It is also possible to use a known surface treating agent and a known binder which are generally used, together with the fillers.

A composition to which desired properties are imparted by adding a nucleating agent, a pigment such as a carbon black or the like, an antioxidant, a stabilizer, a plasticizer, a lubricant, a release agent and a fire retardant to a liquid crystal polymer composition is also included in the range of the liquid crystal polymer composition referred to in the invention.

In the liquid crystal polymer composition of the invention, one or more fillers are used to compensate the respective defects, whereby a material having an excellent low warp is obtained without impairing mechanical properties. Further, fillers are uniformly dispersed in a molded article, and a higher performance is exhibited in a dispersed state where plate-shaped fillers are present between fibrous fillers.

Such a liquid crystal polymer composition can be produced by compounding both components at the foregoing

composition ratios and extruding the same. Usually, they are extruded into pellets with an extruder, and the pellets are used in injection molding. However, the production with the extruder is not critical.

Brief Description of the Drawings:

Fig. 1 is a view showing a shape of a connector test piece used in Examples. (a) is a front view, (b) a bottom view and (c) a sectional view taken along line A-A of (a).

EXAMPLES

The invention is illustrated specifically by referring to Examples. However, the invention is not limited thereto. The measurements of the properties and the tests in Examples were conducted by the following methods.

(1) Measurement of an average particle diameter of a plate-shaped filler

An average particle diameter was measured by a laser scattering method, and shown in terms of a cumulative 50% average particle diameter.

(2) Measurement of the shape (D/W, W/H) of a plate-shaped filler

Pellets of a liquid crystal polymer composition extruded with a composition shown in Table 1 were burned at 600°C. Then,

a filler remaining as an ash was photographed using a scanning electron microscope. This photograph was subjected to image analysis, and its average value was calculated.

(3) Tensile test

A tensile strength and a tensile elongation were measured according to ASTM D638 using an ASTM No. 1 dumbbell test piece.

(4) Flexural test

A flexural strength and a flexural modulus were measured according to ASTM D790 using a flexural test piece having a size of 130 x 13 x 0.8 mm.

(5) Measurement of a flatness of a flat plate

A flat plate having a size of 60 x 60 x 0.7 mm was fixed on a level plate (platen) at three points. A height of a position which was raised most from the platen was measured, and an average of three plates was obtained.

(6) Measurement of a warp of a connector shape

In a connector-type test piece having a pitch between terminals of 0.6 mm, an average thickness (t) of 0.3 mm and an external size of 4 mm (width) x 4 mm (height) x 60 mm (length) and provided with blank portions as shown in Fig. 1, a distance between a straight line obtained by binding points of both ends of the fixed surface of a connector and a central point thereof was measured, and an average of 10 connectors was obtained.

Examples 1 to 8 and Comparative Examples 1 to 6

Each filler shown in Table 1 at a ratio shown in Table 1 was dry-blended with 100 parts by weight of a liquid crystal polyester (LCP; Vectra E950i manufactured by Polyplastics Co., Ltd.), and the mixture was then melt-extruded and pelletized with a twin-screw extruder (PCM-30 manufactured by Ikegai Iron Works, Ltd.). The foregoing test pieces were produced from the pellets using an injection molding machine, and evaluated. The results shown in Table 1 were then obtained.

Table 1

	(A) LCP (parts by weight)	Filler (parts by weight)			Average particle size of (B) plate-shaped filler (μm)	Shape of (B) plate-shaped filler		Tensile test		Flexural test		Flatness of flat plate (mm)	Warp of connector shape (mm)
		(B) plate-shaped	(C) fibrous	others		D/W	W/H	Tensile strength (MPa)	Tensile elongation (%)	Flexural strength (MPa)	Flexural modulus (MPa)		
Ex. 1	100	talc 50			10.5	1.1	12	119	2.8	158	13900	0.12	0.269
Comp. Ex. 1	100		GF 50		-	-	-	178	2.0	240	21400	0.89	0.545
Ex. 2	100	talc 60	GF 20		10.1	1.1	11	120	2.5	160	14700	0.10	0.230
Ex. 3	100	talc 20	GF 30		9.8	1.0	11	140	2.7	202	16700	0.07	0.230
Ex. 4	100	fine talc 20	GF 30		1.3	1.3	4	137	2.8	191	16700	0.18	0.220
Ex. 5	100	mica 20	GF 30		19.2	1.5	42	138	2.5	199	17300	0.20	0.272
Ex. 6	100	kaolin 20	GF 30		5.0	1.2	7	135	2.6	189	16500	0.25	0.270
Ex. 7	100	graphite 20	GF 30		15.5	1.2	21	132	2.7	187	16200	0.35	0.285
Ex. 8	100	wollastonite 20	GF 30		5.0	2.4	3	132	2.8	190	16800	0.32	0.232
Comp. Ex. 2	100	wollastonite 20	GF 30		20.3	5.0	1.2	140	2.5	210	17700	0.95	0.319
Comp. Ex. 3	100	wollastonite 20	GF 30		89.5	8.4	3	147	2.3	223	18500	0.89	0.332
Comp. Ex. 4	100		GF 30	spherical silica 20	-	-	-	139	2.5	202	17700	12.13	0.360
Comp. Ex. 5	100		GF 30	titanium oxide 20	-	-	-	136	2.6	183	15200	4.42	0.471
Comp. Ex. 6	100		GF 30	calcium pyrophosphate 20	-		-	140	2.6	202	17200	8.55	0.378

*GF: glass fiber having an average fiber diameter of 10 μm, and an aspect ratio of 40

CLAIMS:

1. A liquid crystal polymer composition comprising 100 parts by weight of a liquid crystal polymer (A) and 5-100 parts by weight of a plate-shaped filler (B) satisfying the following formulae (1) and (2) and having an average particle diameter of 0.5-100 μm.

$$D/W \leqq 5 \qquad (1)$$

$$3 \leqq W/H \leqq 200 \qquad (2)$$

wherein D is the maximum particle diameter of the plate-shaped filler (B), and the direction of the diameter D is defined as x; W is a particle's diameter which is in the direction y at the right angle to the direction x; and H is a thickness of the particle in the direction of z which is vertical to the xy-plane.

2. The composition according to claim 1, wherein 5-100 parts by weight of a fibrous filler (C) having an average fiber diameter of 5-20 μm and an average aspect ratio of at least 15 are further compounded therewith to 100 parts by weight of the liquid crystal polymer (A).

3. The composition according to claim 1 or 2, wherein the plate-shaped filler (B) consists of at least one substance selected from talc, mica, kaolin and graphite.

4. The composition according to claim 2 or 3, wherein the fibrous filler (C) is glass fiber.

5. The composition according to any of claims 1 to 4, wherein the liquid crystal polymer (A) is a polyester amide.

6. A connector which is manufactured from the composition mentioned in any of claims 1-5.

ABSTRACT

This invention offers a liquid crystal polymer which exhibits an excellent low warp and is advantageously used especially as a connector or the like. That is, a liquid crystal polymer composition in which a plate-shaped filler (B) in an amount of 5-100 parts by weight satisfying the following formulae (1) and (2) and having an average particle diameter of 0.5-100 μm is compounded with 100 parts by weight of a liquid crystal polymer (A).

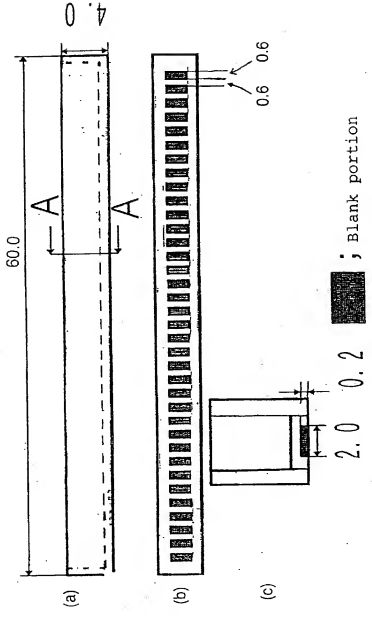
$$D/W \leqq 5 \qquad (1)$$

$$3 \leqq W/H \leqq 200 \qquad (2)$$

wherein D is the maximum particle diameter of the plate-shaped filler (B), and the direction of the diameter D is defined as "x"; W is a particle's diameter which is in the direction y at the right angle to the direction x; and H is a thickness of the particle in the direction of z which is vertical to the xy-plane.

DRAWINGS

Fig. 1



COMBINED DECLARATION AND POWER OF ATTORNEY FOR UTILITY PATENT APPLICATION	Attorney's Docket No. 009760-016

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I BELIEVE I AM THE ORIGINAL, FIRST AND SOLE INVENTOR (if only one name is listed below) OR AN ORIGINAL, FIRST AND JOINT INVENTOR (if more than one name is listed below) OF THE SUBJECT MATTER WHICH IS CLAIMED AND FOR WHICH A PATENT IS SOUGHT ON THE INVENTION ENTITLED:

LIQUID CRYSTAL POLYMER COMPOSITIONS

the specification of which

(check one)
- ☐ is attached hereto;
- ☒ was filed on October 4, 2000 as

Application No. PCT/JP00/06910

and was amended on _____ (if applicable);

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE;

I ACKNOWLEDGE THE DUTY TO DISCLOSE TO THE OFFICE ALL INFORMATION KNOWN TO ME TO BE MATERIAL TO PATENTABILITY AS DEFINED IN TITLE 37, CODE OF FEDERAL REGULATIONS, Sec. 1.56 (as amended effective March 16, 1992);

I do not know and do not believe the said invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to said application; that said invention was not in public use or on sale in the United States of America more than one year prior to said application; that said invention has not been patented or made the subject of an inventor's certificate issued before the date of said application in any country foreign to the United States of America on any application filed by me or my legal representatives or assigns more than twelve months prior to said application;

I hereby claim foreign priority benefits under Title 35, United States Code Sec. 119 and/or Sec. 365 of any foreign application(s) for patent or inventor's certificate as indicated below and have also identified below any foreign application for patent or inventor's certificate on this invention having a filing date before that of the application(s) on which priority is claimed:

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Attorney's Docket No.
009760-016

COUNTRY/INTERNATIONAL	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
Japan	11-287808	8 October 1999	YES X NO_
			YES_ NO_

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

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009760-016

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